TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Vehicle Electronics and Architecture

August 26, 2011

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VEA Vision and Mission

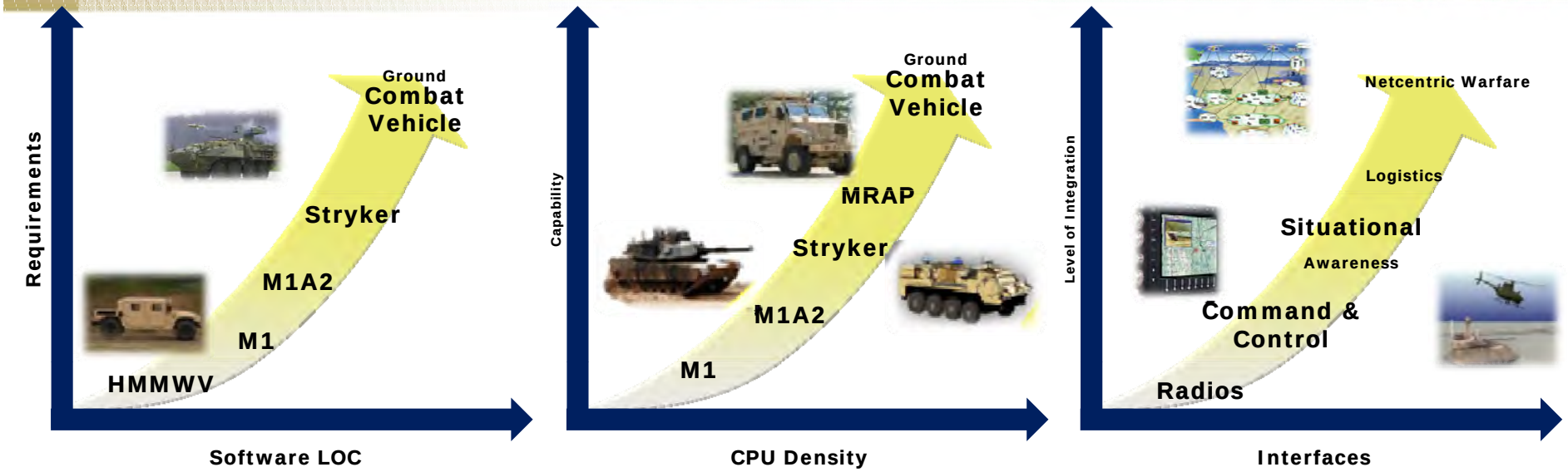
VEA Vision Statement:

VEA will be the first choice to technology and engineering expertise for vehicle electronics integration, research and application – today and tomorrow.

VEA Mission Statement:

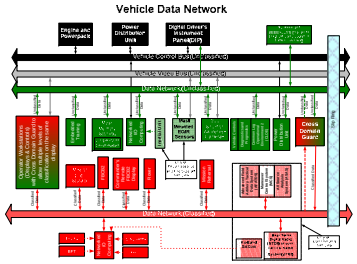
VEA develops, integrates, and sustains the right vehicle electronics technology solutions for all manned and unmanned ground systems and ground combat systems to improve current force effectiveness and provide superior capabilities for the future force. Key vehicle electronics technology areas include power management and distribution, inter-vehicular data networks, computers, software infrastructure, and electronics packaging. VEA will develop and evaluate existing and emerging technologies, standards, vehicle specifications, and vehicle systems.

Increasing Vehicle Electronics



Increasing demands and operational flexibility
Require technology investments in key areas

Vehicle Networks



Architectures

Computers

RDECOM Excellence in Vehicle Electronics TARDEC

Full System Lifecycle Support

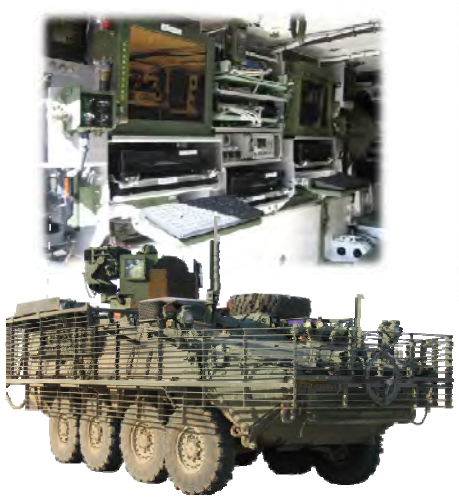





Systems Engineering Processes

Requirements | Architectures & Standards | Software Development | System Integration | Testing | Field Support | Sustainment

Supporting the Current Force




Enabling the Future Fight

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VEA Strategy Map

Vision:

VEA will be the first choice to technology and engineering expertise for vehicle electronics integration, research and application – today and tomorrow.

Mission:

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Ends

1.0 Innovative Human Capital	2.0 Value Added to the Warfighter	3.0 Continuous Improvement	4.0 Alignment

Ways

1.1 Recruit & retain the best and brightest personnel in-line with projected manpower requirements and attrition rates 1.2 Provide training programs and work experience to enhance the workforce's technical competency in-line with organizational needs 1.3 Develop training, educational opportunities and programs to enhance workforce's development, certification and leadership competency in-line with organizational needs 1.4 Reward and acknowledge successful employees	2.1 Develop Vehicle Electrical Architecture infrastructure to lead Ground Domain systems integration 2.2 Develop Vehicle Electrical Architecture to optimize technology integration from both government and industry across the Life Cycle 2.3 Infuse System Engineering into vehicle integration throughout life cycles. 2.4 Provide timely VEA solutions in response to Quick Reaction requirements	3.1 Develop an infrastructure to support VEA research and application and a culture of innovation and continuous improvement 3.2 Implement integrated business and acquisition processes throughout VEA organization 3.3 Strengthen strategic partnerships, alliances, and technology transfer opportunities 3.4 Provide trusted actionable advice and recommendations to customers for VEA decisions	4.1 Balance the VEA portfolio to support the Ground Systems Domain 4.2 Maximize transition of VEA technologies 4.3 Strengthen strategic partnerships, alliances, and technology transfer opportunities 4.4 Facilitate collaboration within RDECOM 's Electronic and Electrical Architecture organizations

Means

5.0 Optimize Resources

5.1 Optimize VEA Resource Management

5.3 Support TARDEC compliance with WSARA, ARFORGEN process, and PEO modernization efforts

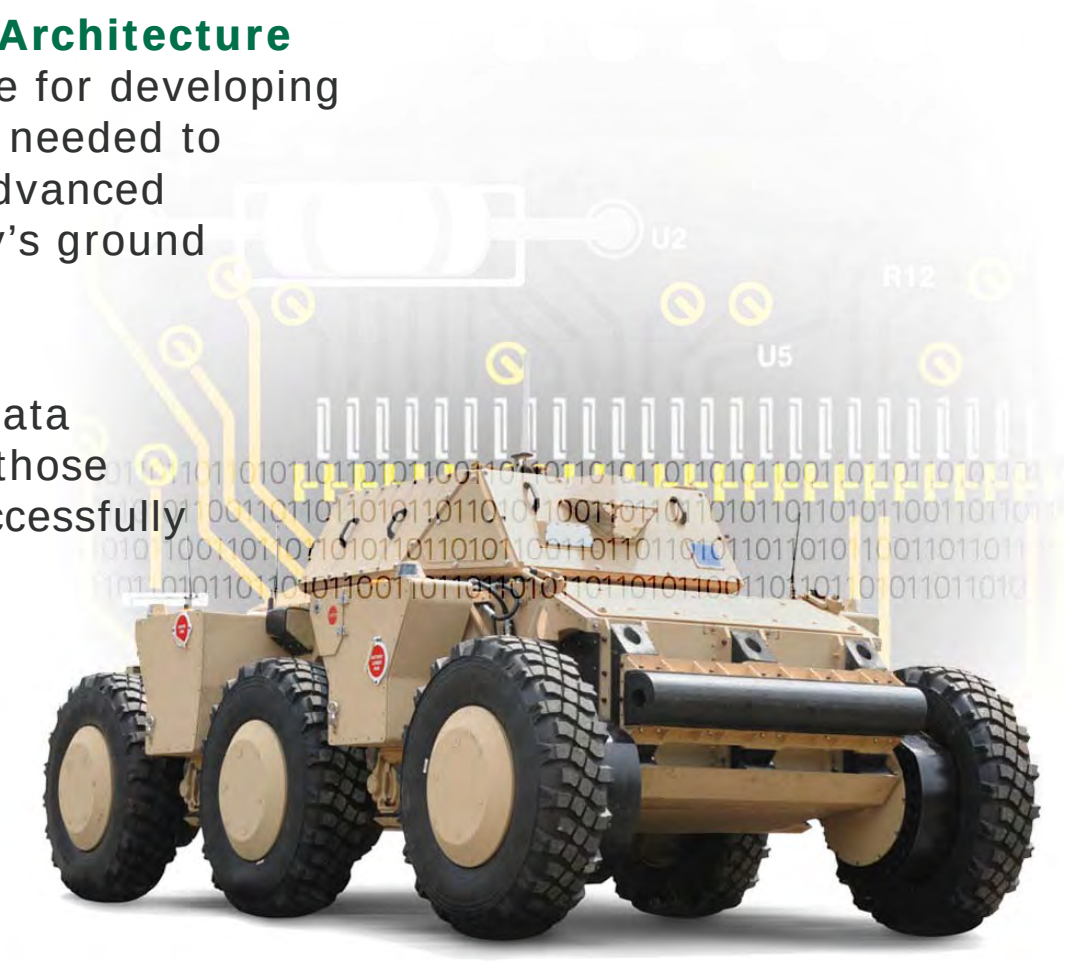
5.2 Optimize VEA Labs to enhance Combat Capability

What We Do

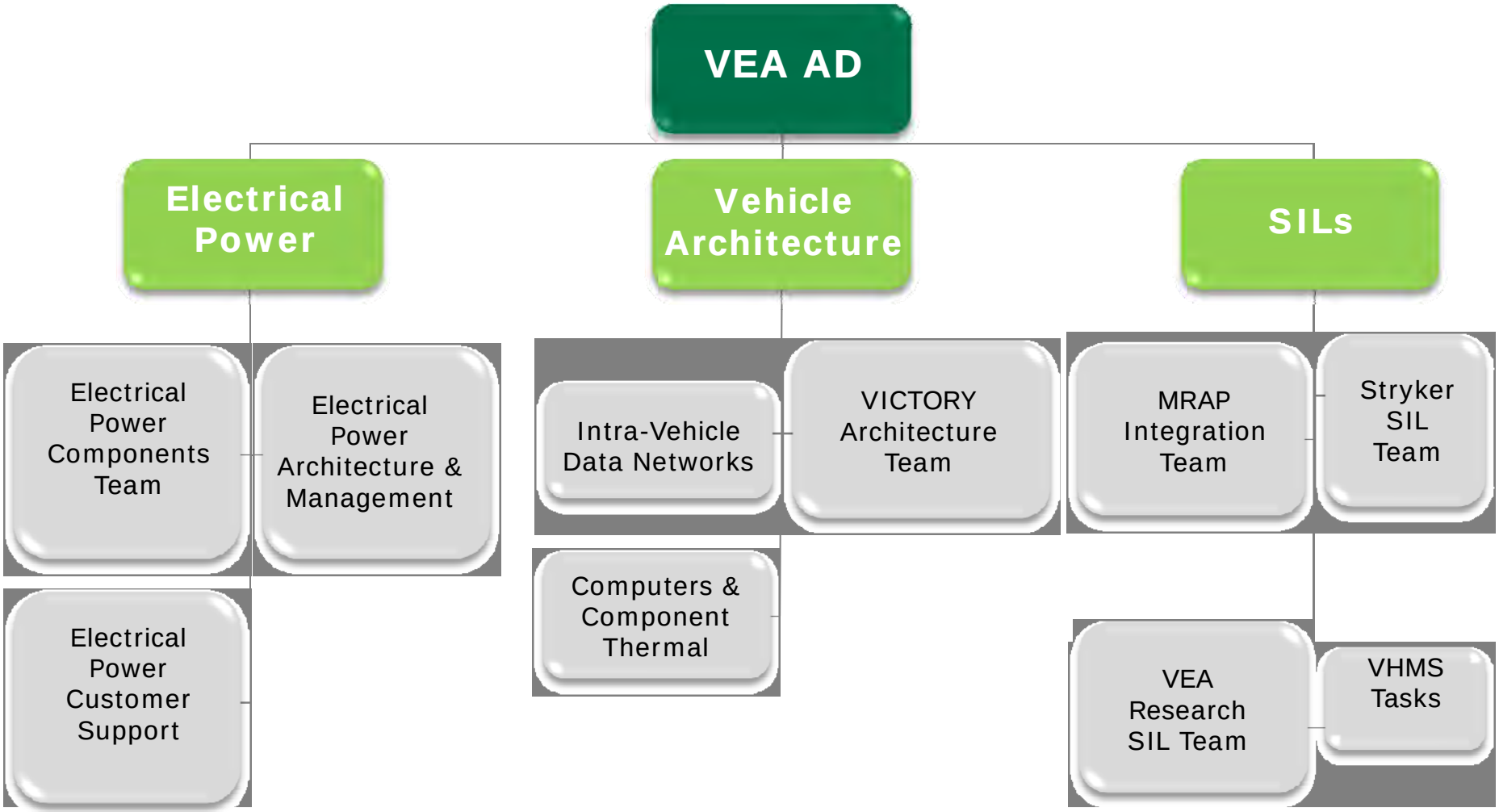
- The **Vehicle Electronics and Architecture (VEA)** focus area is responsible for developing the essential support structure needed to accommodate the numerous advanced technologies prevalent in today's ground vehicles.

- We develop the software and data networks necessary to ensure those technologies work together successfully without compromising power and mobility.

- TARDEC's VEA work centers on three core functions:
  - **Electrical power**
  - **Vehicle Architecture**
  - **Systems integration laboratories (SILs)**



Who We Are

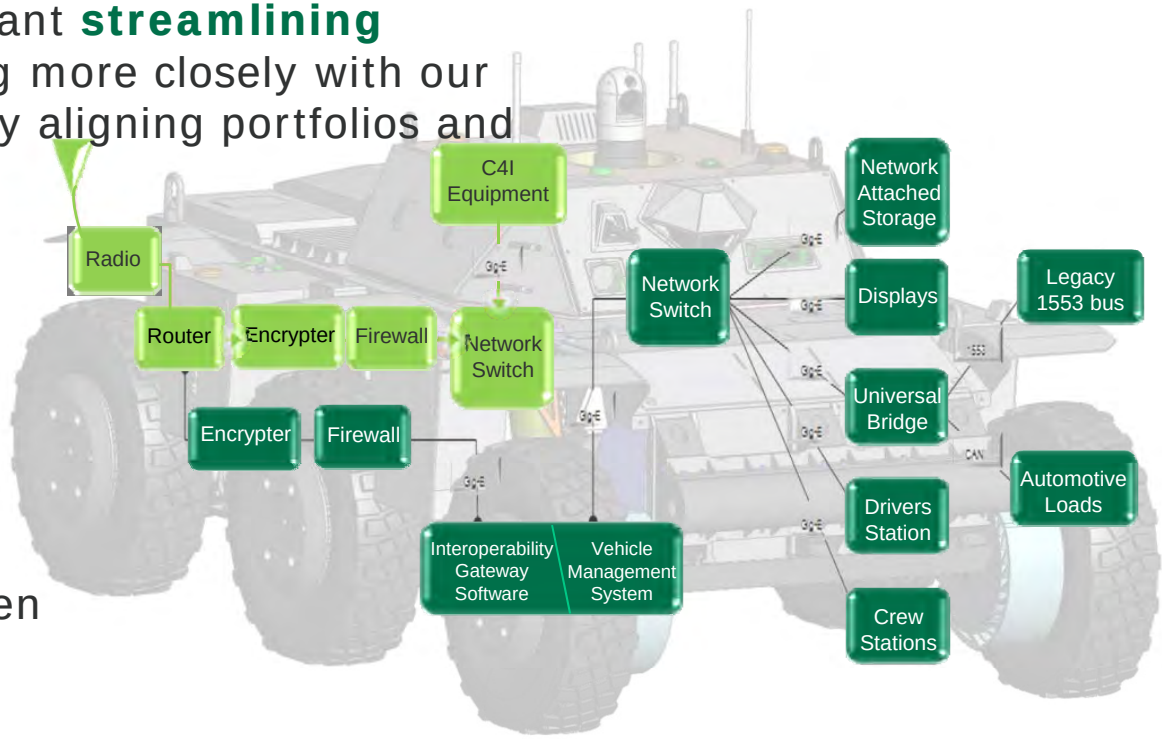

VEA AD
Electrical Power
Vehicle Architecture
SILs
Electrical Power Components Team
Electrical Power Architecture & Management
Electrical Power Customer Support
Intra-Vehicle Data Networks
VICTORY Architecture Team
Computers & Component Thermal
MRAP Integration Team
Stryker SIL Team
VEA Research SIL Team
VHMS Tasks

Doing More Without More

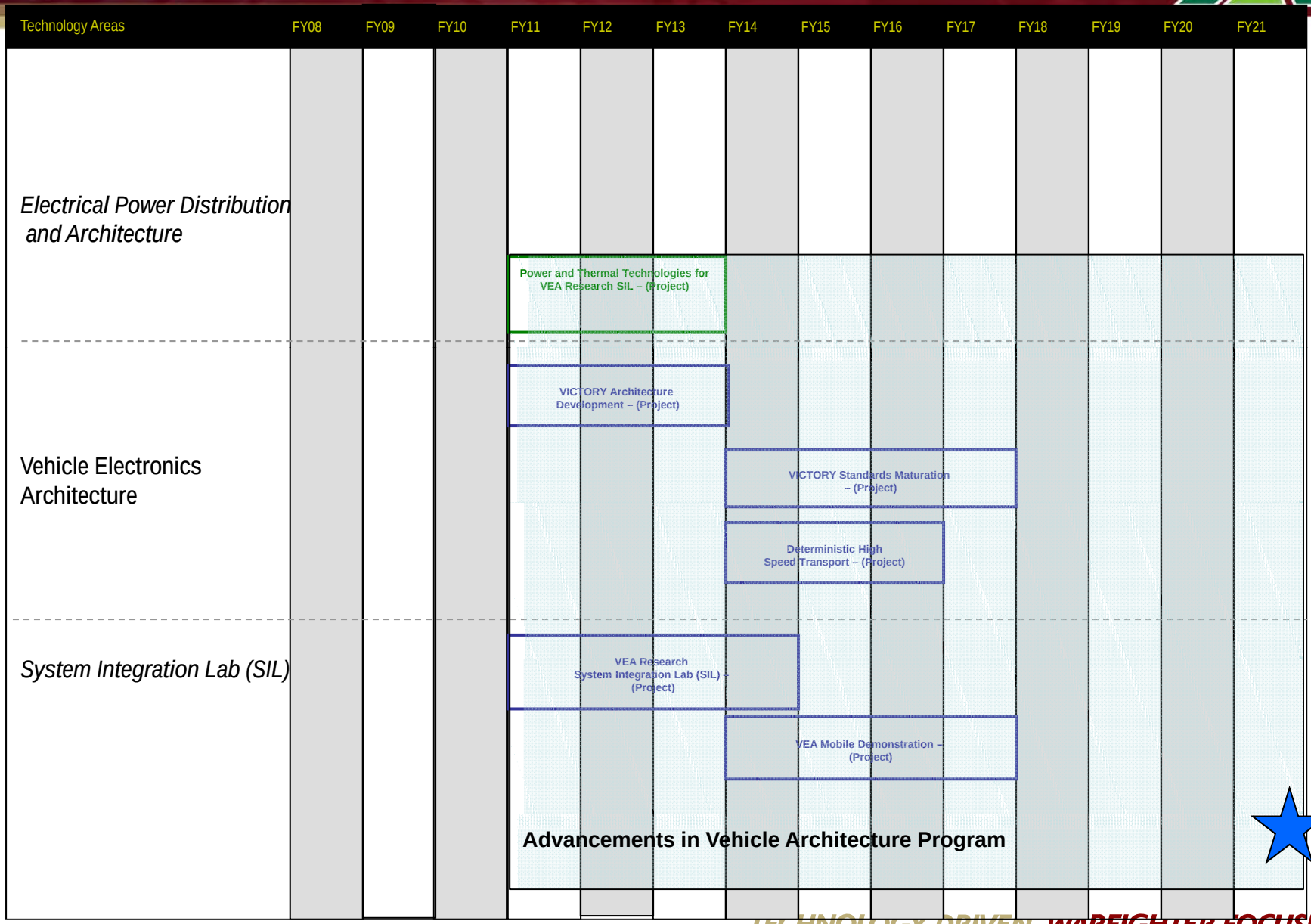
- The Army has placed a renewed emphasis on **developing efficiencies** where possible in order to get the best value from our limited resources.

- At TARDEC this has meant **streamlining processes** and working more closely with our partner organizations by aligning portfolios and leveraging support.

- Several of the major projects currently underway within VEA contribute to these efforts by exploiting the potential for **commonalities** between vehicle platforms.



Vehicle Electronics and Architecture Roadmap – Revised PMR 4QFY11



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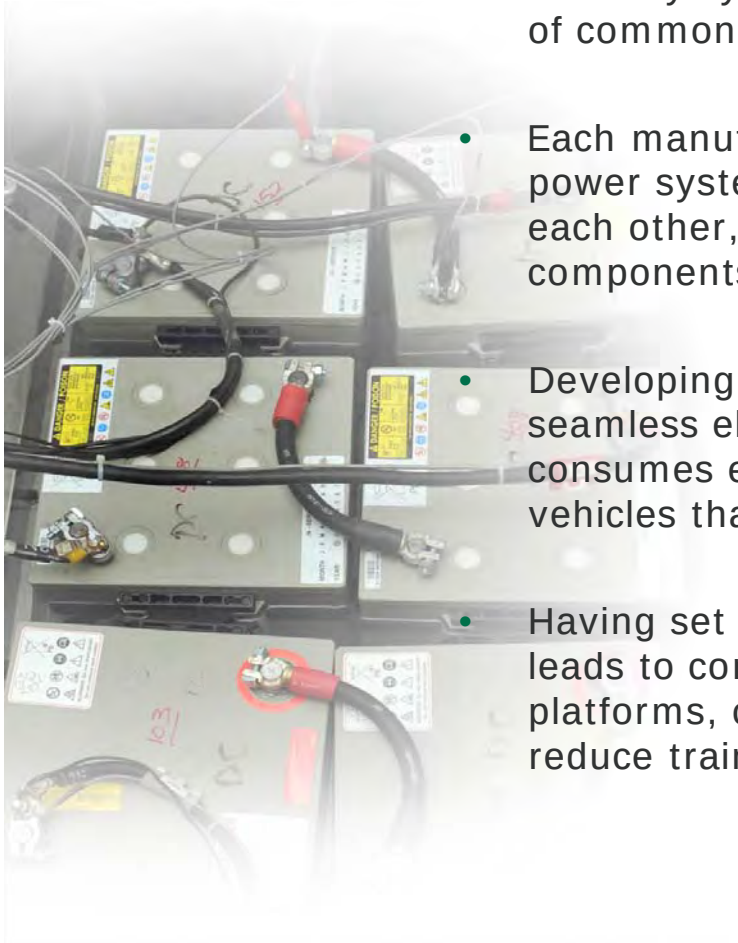
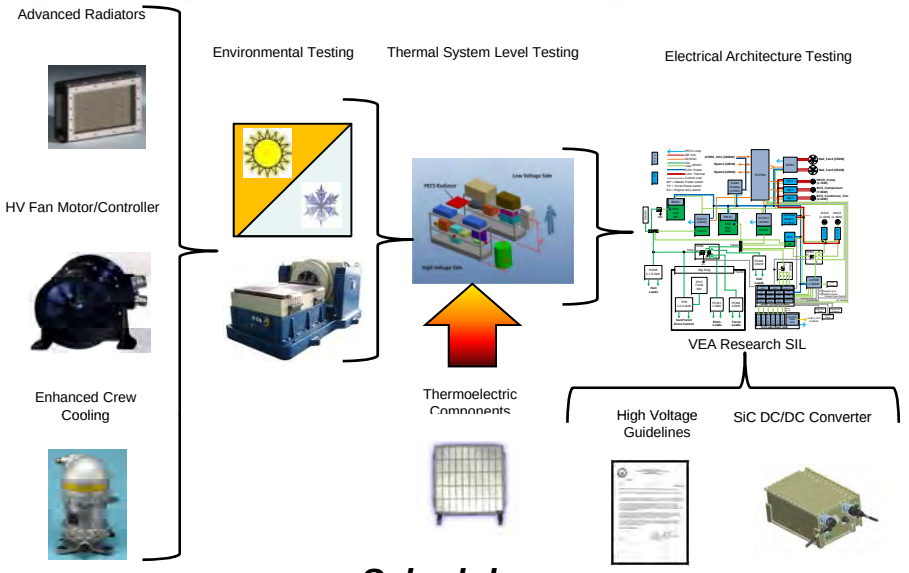
Electrical Power



- The **Electrical Power** group focuses on customer engineering, research and development, architecture and management and auxiliary systems. One current project of note is the development of common electrical power standards.
- Each manufacturer uses its own voltage standard for electrical power systems and the different standards are not compatible with each other, meaning vehicles often require unique solutions and components.
- Developing an enabler for electrical power architecture will allow seamless electrical integration of any load that converts or consumes electrical power. It creates commonalities for ground vehicles that adopt the standards.
- Having set standards for new start and modernization programs leads to common components and plug and play ability between platforms, common implementations and control schemes that reduce training.

VEA–Power & Thermal Technologies for VEA Research SIL



Schedule

Milestones	FY11	FY12	FY13
Systems Engineering			
• *Requirements Analysis and Trade Studies*			
• *HV & LV Standards*			
• *Modeling and Architecture Design*			
Development and Integration			
• *Thermoelectric development*			
• *HV Fan Motor Development*			
• *HV Air Conditioning*			
• *Advanced Radiators*			
• *SiC DC/DC Converter*			
• *Software Development*			
Testing, Verification and Validation			
• *Thermal Simulation Testing*			
• *Thermal systems verification testing*			
• *VEA Research SIL testing*			

PDR CDR

Purpose:

To develop and demonstrate military ground vehicle advanced power and thermal management capabilities in a SIL environment

Products:

- 600VDC Voltage Specification
- 600VDC Safety Specification
- MIL-STD-1275 update
- Modernized Power System Architecture and interfaces
- Power and Thermal Management Software V0.5
- 70kW 600VDC Cooling fan and controller (Si) 6
- 600VDC High efficiency air conditioning (Si) 5
- SiC 600/28VDC DC/DC 10kW converter 5
- Advanced micro-channel radiator for both prime and auxiliary cooling 5
- Thermoelectric module capable of recovering waste heat as usable electric energy at a conversion efficiency 8 - 12% 4

Payoff:

- Decreased SWAP-C requirements and increased efficiency for power and thermal systems (WFO #3: Power and Energy)
- Available for transition to PEO-GCS Mod programs before all MS-Cs and most MS-Bs (FY13)
- TARDEC will own/manage all electrical voltage and HV safety standards and software(Build the Bench)

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LAST Updated: 20110609

Vehicle Architecture

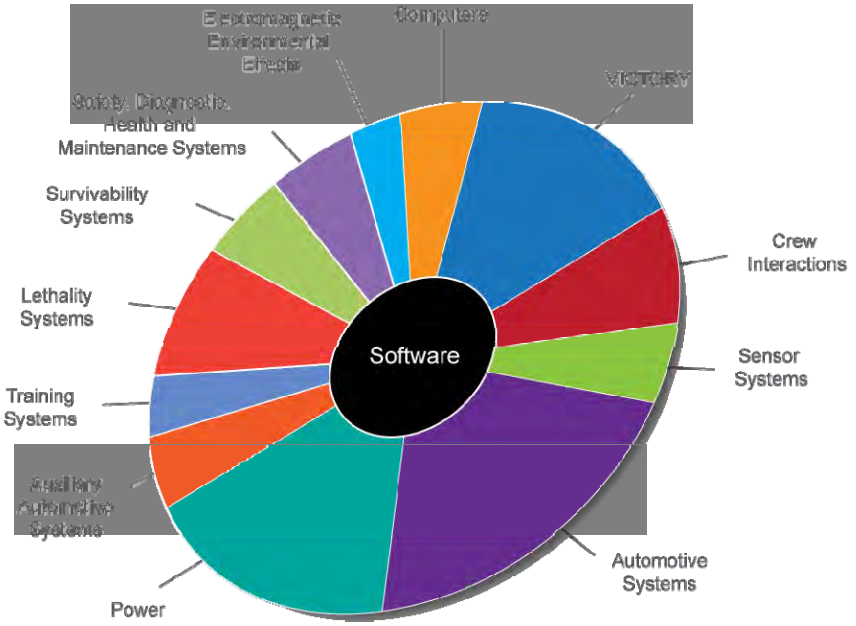
- **Vehicle Architecture** consists of intra-vehicle data networks, computers and component thermal and VICTORY architecture teams.

- One major current focus in this area for TARDEC is the Vehicular Integration for Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance/Electronic Warfare (C4ISR/EW) Interoperability (VICTORY) architecture.

- VICTORY architecture is being developed as a solution to the "bolt-on" approach to integrating C4ISR systems into ground vehicles.

- This approach inhibits functionality, negatively impacts the vehicle's size, weight and power and limits space for the crew.

The Vehicle Architecture Problem Space



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VICTORY Architecture

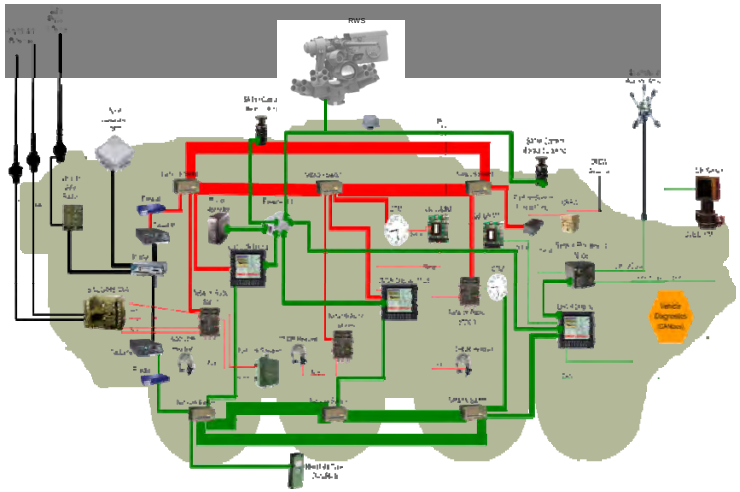
- **VICTORY** will reduce these issues by embedding these systems directly into the platform. It provides a framework architecture, standard specifications and design guideline input.

- Originally initiated by Program Executive Office (PEO) Command, Control, Communications – Tactical (C3T), the program is a joint effort between TARDEC VEA, PEO Ground Combat Systems (GCS) and PEO Combat Support & Combat Service Support (CS&CSS).

- The end result is a capability set readily integrated onto platforms without impeding crew performance.

VEA – VICTORY Architecture Development

VICTORY



Schedule

Milestones	FY11	FY12	FY13
Architechture Development			
- Receive Architecture A			
- Develop Architecture B			
Standards Development			
- Complete VICTORY 1.0 Standard			
- Develop VICTORY 1.X Standard			
VICTORY 1.0 SIL Testing			
- Modify SIL for Standards Validation			
- Perform Validation and Verification on VICTORY 1.0			
- Execute Interoperability Testing on VICTORY 1.0			

Purpose:

Develop and adopt Vehicular Integration for C4ISR/EW Interoperability (VICTORY) Specifications. Develop a System Integration Lab (SIL) reconfiguration package to perform Validation and Verification for the VICTORY Standards to support near term ECP efforts.

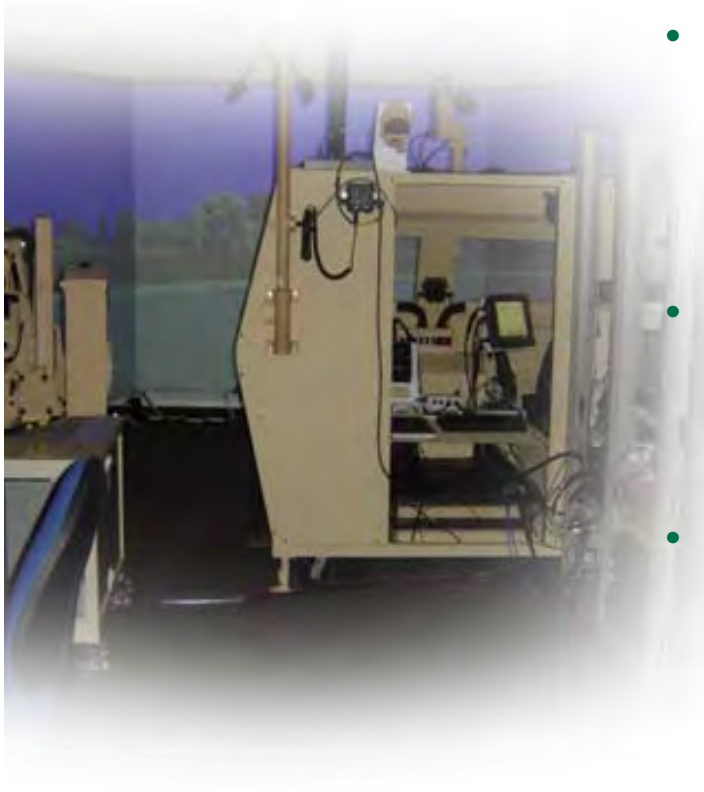
Product(s):

- ***VICTORY Architecture B for the VICTORY SIL***
- ***VICTORY Standard 1.0***
- ***VICTORY Standard 1.X***
- ***VICTORY Standard 1.0 SIL***
- ***VICTORY 1.0 V&V Test Results***
- ***VICTORY 1.0 Interoperability Test Results***

Payoff:

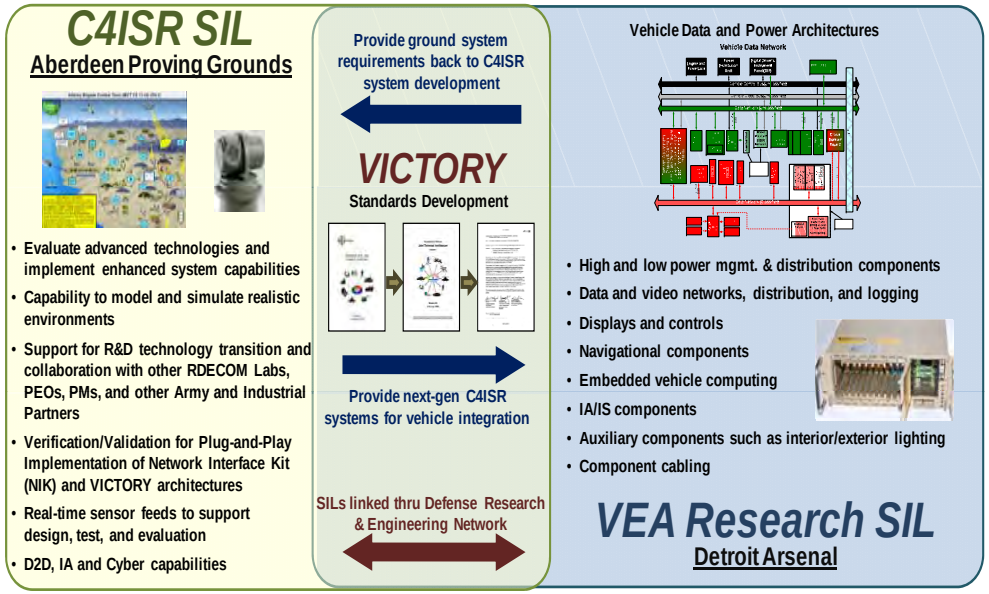
- ***Provides VICTORY Standards and Specifications, a Digital Architecture and a Gigabit Ethernet Bus for Military Combat Vehicles (WFO S-3, B-P1-8, A-P2-22)***
- ***Transition to PEO GCS in FY-13 to support Modernization***
- ***TARDEC will have a VICTORY 1.0 SIL where manufactures can bring components for testing (Shape the Market)***

SIL



- The **SIL** group supports Stryker Brigade Combat Team, Heavy Brigade Combat Team and the Mine Resistant Ambush Protected (MRAP) vehicle Integration Team.
- The SIL will be able to configure multiple vehicle electronics implementations quickly to get valuable data to those who need it.
- It will centralize the Army's approach to integrating electronics on ground vehicles, saving cost and reducing redundant work across multiple programs, while also supporting modernization efforts.
- This group is also working to develop a **Common SIL** that will have the ability to test any piece of hardware to verify it is compatible with an open architecture and is VICTORY compliant.

VEA – VEA Research SIL



Estimated Schedule

Milestones	FY11	FY12	FY13	FY14
Planning & Hiring				
Define Customer Requirements				
Functional Decomposition				
Functional Allocation & Design				
Acquire Resources / Equipment				
Build SIL				
Integrate Subsystems / Components				
Verification / Validation				5

Update cost & schedule estimate based on requirements and design

Purpose:

Develop and demonstrate an implementation of a complete VEA reference architecture to address the power, vetronics, and C4ISR integration challenges facing the ground vehicle domain. The SIL will be reconfigurable to support experimentation with future architectural concepts and implementations. It will centralize the Army's approach to integrating electronics on ground vehicles, saving cost and reducing redundant work across multiple programs.

Product(s):

- ***Vehicle Electronics & Architecture Research SIL***
  - ***HV and LV power electronics*** 5
  - ***Vetronics, C4ISR integrated components*** 5
  - ***Documented DoDAF Architecture Products***
  - ***DREN Interface to other RDEC SILs***

Payoff:

- ***Provide a Gigabit Ethernet Bus for Military Combat Vehicles (WFO A-P2-22, B-11); Decreased SWAP-C requirements and increased efficiency for power and thermal systems (WFO #3: Power and Energy)***
- ***Transitions knowledge base products (DoDAF Artifacts, Reports, Trade Studies, Specifications, etc)***
- ***Central project for the VEA organization (Build the bench)***

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Summary

- TARDEC's VEA **develops and executes Projects and Programs** that are aligned with Army goals and aimed at helping support the current and future force.

- The work of the VEA group makes it possible for the latest, most advanced technology solutions to be integrated into vehicle platforms, which ultimately **ease warfighter burdens and help save lives.**

- VEA will continue to be a **vital part of ground vehicle systems and their development.**